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# USSR Report

CONSTRUCTION AND EQUIPMENT

(FOUO 4/81)



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USSR REPORT  
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## CONSTRUCTION

UDC 629.139.038

## BOOK SUMMARIZES AIRFIELD-CONSTRUCTION TECHNIQUES

Moscow STROITEL'STVO AERODROMOV: SPRAVOCHNIK in Russian 1980 (signed to press 4 Nov 80) title page & pp 2-4, 247-248

[Table of contents, annotation and foreword from "Airfield Construction: a Handbook," by Candidate of Engineering Sciences Boris Ivanovich Demin, Engineer Vladimir Petrovich Yegozov and Candidate of Engineering Sciences Yuriy Alekseyevich Ratyuk, edited by B. I. Demin, Izdatel'stvo "Transport", 4,600 copies, 248 pages.

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Handbook data on modern methods for organizing and performing airfield construction work and on the materials, machinery and mechanisms used for carrying them out are cited. Rules for monitoring the quality and acceptance of operations and for work safety techniques during the conduct thereof are examined.

Advanced experience in production organization and the newest recommendations of scientific-research organizations are reflected.

The handbook is intended for airfield construction engineers and technicians, and it can be recommended for students of the airfield-construction specialty.

There are 37 illustrations, 229 tables and 38 bibliographic entries.

## Foreword

A rise in the capacity and quality of the operation of all transport systems and improvement of the transport links among our country's economic regions are the bases for more complete and timely satisfaction of the demands of the national economy and of the populace for hauling freight and for moving passengers.

Air transport is being developed at a rapid pace. Continuous growth in hauling by air transport, especially over long distances and to regions difficult of access, requires the creation of a highly developed network of airports for ground support of aviation operations.

The main component of an airport is the airfield--a specially prepared section of land that includes a complex of buildings and equipment that will provide for take-offs, landings, taxiing, and the storage and technical servicing of aircraft. Among the basic and expensive engineering structures of a modern airfield are the artificial surfaces of the runways, taxiways, ramps and hardstands. Modern aviation presents extremely high demands on the strength, smoothness and operational durability

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of the surface layer of artificial airfield surfaces. Their quality determines to a great extent the safety and regularity of aircraft flights.

High operational qualities of airfield structures depend to a significant degree upon the methods used and the quality of execution of the construction and installing work. Domestic and foreign experience indicate that more than 50 percent of the defects that appear during operations on airfield surfaces are the consequence of construction deficiencies.

Because of this, improvement of methods for organizing airfield construction work and the technology for executing it, as well as the introduction of progressive structure and materials, are acquiring special significance.

It is the task of airfield builders to constantly achieve, along with high operational qualities and durability for airfield structures, high rates of construction and labor productivity with a simultaneous reduction of costs.

These can be achieved by the use of highly productive machinery, the integrated mechanization and automation of operating processes, advanced methods for organizing construction work, and a rise in the level of industrializing construction.

A substantial reduction in the time taken to build airfield surfaces and a rise in labor productivity are achieved by using highly productive sets of railfree concrete-placing machines and prefabricated pavement made of prestressed reinforced-concrete slabs. The quality of airfield structures depends to a great extent upon the quality of the materials used to erect them.

Prefabricated pavement made of prestressed reinforced-concrete PAG-type slabs that are produced serially by reinforced-concrete industry plants have been introduced widely into airfield-construction practice. For constructing rigid monolith pavements, highly productive domestically produced railfree sets of machines are used, and the introduction of high-strength airfield concrete with a tensile strength under bending of 60 kg-force/cm<sup>2</sup> or more has started. All this will promote a further rise in the effectiveness and quality of airfield construction.

It is also important to provide the builders with the necessary engineering literature.

Based upon the results of scientific research that has been conducted and on a study of advanced experience in airfield-building organizations, a large amount of standardizing, recommendatory, informational, training, scientific and technical literature has been developed and published.

At the same time, not until now has a handbook been issued in which are concentrated the basic data that airfield builders need for the responsive solution of many questions. This handbook is a first attempt to fill this need.

The basic purpose of the handbook is to help engineers and technicians to solve practical questions in support of airfield construction at a modern level and with high quality.

Candidate of Engineering Sciences B. I. Demin wrote the foreword, chapters 2 and 6 and §5.1 and §5.4 of chapter 5 of the handbook; Engineer V. P. Yegozov wrote

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chapters 3, 4, 7, 8 and 10 and §5.2 and §5.3 of chapter 5; and Candidate of Engineering Sciences Yu. A. Patyuk wrote chapters 1 and 9.

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## CONSTRUCTION

### CAPITAL CONSTRUCTION OF PETROLEUM INDUSTRY STRUCTURES DISCUSSED

Moscow NEFTYANAYA PROMYSHLENNOST' SERIYA "NEFTEPROMYSLOVOYE STROITEL'STVO" in Russian No 1, 1981 pp 2-6

[Article by Sh. S. Dongaryan, in the Ministry of the Petroleum Industry: "Capital Construction of Petroleum Industry Structures"]

[Text] During the 10th Five-Year Plan the development of the petroleum industry was characterized by high rates of growth in the volumes of petroleum that were extracted which was achieved principally by means of the forced development of petroleum deposits in Western Siberia and an increase in the volumes of capital investments and construction and installation work that were directed toward developing deposits, constructing, reconstructing and technologically reoutfitting enterprises and installations for transporting petroleum and preparing and processing natural gas byproducts, and enterprises for repairing and manufacturing equipment for drilling and extracting petroleum.

In 1980 the volume of capital investments and construction and installation work increased by a factor of 1.6 in comparison with 1976. It became possible to achieve the limits that were set for extracting petroleum and to execute the required volumes of capital investments and construction and installation work as a result of realizing the program for further improving the technology of extracting petroleum and extensively introducing industrialized methods of construction.

The principal trend in the area of industrializing the construction of petroleum industry structures is the completely equipped modular section construction (BKS) method. The use of the advanced method has made it possible to create new technological, spatial planning and structural approaches for the complex of structures at an installation in the form of transportable modular sections having a large unified mass and a high level of automation and factory preparedness that provide a reduction in fuel and energy consumption by 15 to 20 percent, material consumption by 20 to 30 percent and labor resources by a factor of 2 to 2.5, and provide an improvement in the system of designing, manufacturing, delivering equipment, and construction. The concentration of capital investments and material and technological resources and the completely equipped nature of the modular section equipment delivered by the plant has made it possible to significantly reduce the duration of construction and the timeframes for starting up and developing new capacities.

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During 1976 to 1980 the production of 17 new types of modular section automated equipment (BAO) was mastered. Approximately 10,000 complete sets of BAO were turned out for the sum of more than 500 million rubles. The first completely equipped modular section installations with a weight of up to 200 tons were made in our country having been given the name super modular sections.

In 1980 almost 4 times as many completely equipped modular section installations were manufactured in comparison with the first year of the 10th Five-Year Plan while the number of workers per 1 million rubles of construction and installation work (SMR) decreased almost by half.

Work was done to create, produce and construct pumping stations for mainline transportation structures using modular section boxes for auxiliary purposes by member-countries of SEV [Council for Mutual Economic Aid] in collaboration with the Ministry of Construction of Petroleum and Gas Industry Enterprises.

Highly productive methods of laying mainline and industrial pipelines have been adopted on the basis of primarily using contact welding, thin layers of casings, basic technology for welding pipe runners and automated methods of controlling the pipelines that are built and by using motor vehicle transportation that is able to pass through areas with more difficult terrain which makes it possible to convey individual pipes and pipe sections to the line.

The adoption of complete sets of prefabricated structural building components and also structural components with lighter weight shapes and inflated casings has been accomplished. During the 10th Five-Year Plan one million square meters of buildings from lighter weight structural components were built. This provided a reduction in the estimated cost of building such structures by 11 to 12 percent.

Modern technological means were used for transporting and assembling structural building components and equipment. Approximately 100 types of new machines and mechanisms were developed which make it possible to increase labor productivity by 15 percent. The use of standardized sets of devices and small size means of mechanization aided in increasing the labor productivity of construction workers by 20 to 40 percent. The technological outfitting of design organizations was done by means of introducing new technology (the EVM [electronic computer], curve plotters and others) within the framework of the SAPR [automated planning system]. The use of computer technology increased the quality of designs for laying out petroleum industry structures and roads, and reduced design time. As a result of carrying out all of these programs higher technological and economic indices were obtained for capital construction. The relative proportion of SMR that was done directly at the construction site in 1980 decreased in comparison with 1976. The level of incomplete construction was reduced. At the end of 1975 the volume of incomplete construction comprised 72 percent of the yearly amount of capital investments while 57 percent was projected at the end of 1980.

Together with this the pace for adopting BKS does not correspond to the growth in capital investments. The relative proportion of the cost of BKNS [expansion unknown] decreased by 5.7 percent for the five-year plan. This was brought about by a lag in the production of modular section equipment relative to sector demand.

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Up to the present time the output of auxiliary equipment, inter-modular section and intersite connections in modular section form has not been developed to a full degree in production; the completely equipped delivery of petroleum industry structures to the construction site has not been realized.

The growth in the volumes of capital construction during the 11th Five-Year Plan will require faster rates of construction, an improvement in its efficiency, and an orientation toward the end results for the national economy. The solution to these complicated and crucial problems is related most of all to an improvement in the level of management of the capital construction system that will provide an increase in construction efficiency by means of adopting the achievements of scientific and technological progress and by reducing unproductive losses in designing and construction production.

1. In the field of improving organizational management, work is scheduled to be done in two main directions.

The creation of an optimum management system over all participants in the processes of designing-manufacturing-construction for orienting them toward unified sector results on the basis of eliminating disagreements in the standard legal basis of making decisions. For this aim the principles of Special Purpose Program SKS: XI-XII "Improving Management of the System of Capital Construction for the Petroleum Industry during the 11th and 12th Five-Year Plans" were worked out, the realization of which will make it possible to eliminate unproductive losses of time and resources that arise as a result of a lack of coordination of the activities of the participants that are in various organizational systems. An organizational basis is being formed for realizing this program and documents have been prepared for publication with the criteria and legal basis for Special Purpose Program SKS: XI-XII.

Improving the management of one's own construction organizations. The second direction is closely connected with the first (The Special Purpose Program) and it achieved the greatest development during the experimental perfecting of the "Tatneft" Association's management of its own construction organizations.

At the present time on the basis of interim results a program for further developing one's own construction organizations and improving management is being worked out in the Ministry of the Petroleum Industry.

In the area of adopting the achievements of scientific and technological progress a "Plan for the Technological Development of Petroleum Industry Construction," which has been worked out by the Ministry of the Petroleum Industry is expected to be realized as well as appropriate programs for mainline transportation, gas processing and other production subsectors. The aim of these programs is to create conditions which will ensure high technological and economic indices for constructing and utilizing structures while accelerating the start up of their operations and increasing labor productivity in construction by a factor of 2 to 2.5. For this, more perfect combined spatial planning and structural approaches to the structures are required which will make it possible to form transportable modular section installations with a single large mass and a high level of automation and factory preparedness. It is necessary to perfect the systems of designing, manufacturing and construction (including

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the planning and management by these workers) in order to ensure the completeness of the deliveries of complexes for developing petroleum deposits and also the standard legal basis for realizing the programs for developing scientific and technological progress in construction and for creating a legal basis for the completely equipped modular section construction method.

The plan specifies the formation of industrial production as well: in making completely equipped modular section structures for collecting and transporting products from petroleum boring holes; central points for collecting and preparing petroleum, gas and water; for maintaining pressure in the strata and the industrial water supply; for increasing the petroleum yield from the strata; for exploiting boring holes by an air lift method; for destroying and utilizing the residue that is extracted when treating the strata's waste water. These tasks are being done on a unified methodical basis which encompasses working out standardized technological schemes for structures and complexes; determining the quantitative level of the capacities of the structures and the parametric level of the modular section equipment; working out standardized combined approaches to structures and organizing the working out of deficiencies and the modernization of existing equipment and its industrial manufacturing. Developing completely equipped modular section technological structures will be done on the basis of standardizing the different types of equipment which will make it possible to improve the serial nature of production and significantly increase the volumes of equipment being manufactured by existing production capacities;

buildings and structures for secondary and auxiliary, administrative and management services, shelters for modular section equipment and technological installations and also watch and operation settlements. The formation of new efficient materials and industrialized structural components for buildings plays an important role in this direction. It is suggested that a new system of complete deliveries be formed having in mind the transfer of the functions for completing the equipment to the enterprises that do the prefabrication work and complete equipping and the organization of deliveries of structures and complexes with all the basic and auxiliary equipment including intermodular section and intersite utility lines.

With the aim of providing construction sites with the required types of products and amount of completely equipped modular section installations it is specified that production capacities for turning out equipment be created. When this is done much attention will be given to improving the technological processes for producing equipment and the specialization of the plant-manufacturers.

Considering the fact that the existing capacities of the construction industry's bases are insufficient and also their increasing role in the completely equipped modular section method of construction, comprehensive work is specified by the plan which is aimed at creating and efficiently placing completely equipped modular section production bases for manufacturing large size modular sections. The creation of a new structure and forms for construction organizations and new forms for evaluating their activity will be an important moment in the perfection of the construction industry which is extremely necessary under conditions of adopting the completely equipped and operations-watch method of construction on a mass scale.

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Comprehensive work is specified to be done to create methods and technological means for transporting and building structures utilizing completely equipped modular sections. It is necessary to enlist the aid of the organizations of the Ministry of Construction of Petroleum and Gas Industry Enterprises, the Ministry of the Automotive Industry, the Ministry of Construction, Road and Municipal Machine Building, the Ministry of the Aviation Industry and the Ministry of the Shipbuilding Industry to resolve this work.

The plan specifies that methods for evaluating and planning the level and economic effectiveness of the completely equipped modular section method of building structures for developing petroleum deposits be improved. This work will make it possible to determine the optimum level of industrialization for construction, its effect on the technological and economic indices of structures for developing petroleum deposits and regulate problems with pricing completely equipped modular section equipment.

3. An important role in improving capital construction is attributable to technological unification and standardization--the primary links in the system of controlling the technological level and quality in design and construction. At the present time a number of standard technical documents have been worked out that are aimed at improving the quality of design and construction, reducing fuel, energy and material consumption, reducing construction time and developing new capacities. Further improvement in the standard technical documents specifies:

creating a system of standard technical documents encompassing the entire investment process from discovery of the deposit and verification of the reserves to the development of the design capacities;

eliminating existing functional excesses in the standard technical documents that are related to the adoption of the completely equipped modular section method of construction;

eliminating existing discrepancies in the standard technical documents;

creating new standard documents that take into consideration the shift of capital construction into regions with difficult natural and climatic conditions and also the development of deposits of petroleum with high levels of viscosity and petroleum containing hydrogen sulfide.

The efforts of all participants in creating and utilizing petroleum industry structures must be directed toward a solution to this direction of work.

4. In the area of further improving the Ministry of the Petroleum Industry's design complex an improvement in planning design and research work is specified as well as in the organization and technology of the design process, the perfection of methods of managing planning and estimate affairs, and the adoption of an overall system of controlling the quality of design and research work. Toward this goal the Ministry of the Petroleum Industry has completed a transfer to a new system of designing (TEO [expansion unknown]--working drawings), and development of phase one of an SAPR for petroleum is being completed, etc. The planned work will make it possible to increase the technological and economical level of the design approaches while improving quality and reducing the time for working out designs.

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Large and complicated problems have to be solved for developing the petroleum industry in Western Siberia.

Starting to develop a large number of distant deposits requires unprecedented construction for it, main highways to them and structures for supplying power which must eliminate the seasonal nature of the work of boring and construction organizations and significantly increase the efficiency of their work. This will also make it possible to gradually reduce the projected volumes of material and equipment supplies that change hands.

Together with the construction of main highways in Western Siberia it is necessary to complete construction of motor vehicle access routes to the groups of petroleum boreholes on an extensive scale. Since the beginning of exploiting the Western Siberia deposits such access routes have not been built since there was not sufficient capabilities for building even main highways. But relative to the fact that conditions for exploiting the boring holes are becoming more complicated (the allotment of the available mechanized equipment will comprise more than 70 percent in 1985), the lack of motor vehicle access routes to the groups of boreholes will lead to delays in repair work and consequently to considerable losses of petroleum extracted.

With the aim of eliminating the loss of light grades of petroleum the construction of petroleum settling installations is projected for the forthcoming five-year plan along with the construction of gas processing plants in Western Siberia for utilizing natural gas. This will make it possible to significantly increase the production of a wide range of grades of hydrocarbons and at the same time meet the needs of the petrochemical industry for this valuable raw material. It is necessary to build a system of product pipelines from Western Siberia to Uralo-Povolzh'e for transporting the broad range of grades of hydrocarbons.

Completing such large volumes of work for developing the petroleum industry is possible under conditions where the extremely important program for non-production construction is implemented.

The difficulty in accomplishing this goal is contained not only in the fact of the absolutely large volumes but also in the fact that a large portion of this construction must be done in new cities and settlements. Construction organizations in many republics and oblasts have been enlisted in order to complete the programs for building housing and structures for cultural and everyday purposes in Western Siberia.

Completing such large tasks requires searches for new methods, chiefly organizational. It is desirable to implement the following measures.

1. The decisive factor in expanding the volumes of construction is the formation of a suitable base for construction. At the same time the formation of this base requires that huge material and personnel resources be directed toward its construction which will inflict considerable harm to the construction of petroleum industry structures. On the other hand it is necessary to build a large amount of housing, cultural and everyday structures both for the construction workers of this base and the operating personnel which will also have a harmful effect on providing the workers who are doing the primary operations with housing and everyday conditions.

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In this regard it seems expedient to form reinforced concrete and metal structural components plants, large panel housing construction plants, sanitation and pipe billet plants, and plants that do capital repair work on machines, mechanisms and means of transportation within the rayons of Western Siberia where there is petroleum construction. This is expedient even though all of the building materials, raw materials and rolled metal are transported to the northern part of Tyumenskaya oblast from other rayons of the country.

In order to accelerate the realization of this program it would have been expedient to transfer the KPD [Large Panel Housing Construction], reinforced concrete, and metal structural components plants and gravel strip mining operations that are already in operation in other rayons of the country to the construction organizations in the Western Siberia petroleum and gas complex.

2. The organizations of the USSR Ministry of Installation and Special Construction Work as a subcontractor of the Ministry of Construction of Petroleum and Gas Industry Enterprises could have made a large contribution toward forming capacities for the Western Siberia petroleum industry. At the present time the USSR Ministry of Installation and Special Construction Work is participating only in the installation of gas processing plants, gas lifting compressor stations and storage tanks at the main petroleum transferring stations on the main petroleum pipelines.

In order to accelerate the construction of petroleum industry structures in Western Siberia it is expedient to charge the USSR Ministry of Installation and Special Construction Work with executing installation work at all structures.

3. In the interests of the work the fact that the organizational structure of gas extracting enterprises in Western Siberia was changed requires that the organizational structure of construction organizations in the Ministry of Construction of Petroleum and Gas Industry Enterprises also be changed:

to form construction associations in Nizhnevartovsk, Surgut, Nefteyugansk on the basis of general construction and pipe trusts;

to form construction trusts affiliated with new petroleum extracting administrations;

to reserve construction of only structures for the petroleum industry (excluding main petroleum pipelines) for the Main Tyumen Administration for Construction of Petroleum and Gas Industry Enterprises having also placed under its jurisdiction the "Tomskgazstroy" Trust;

to reserve construction of main gas and petroleum pipelines for the Main Siberia Pipeline Construction Administration;

to form a new main administration--the Main Tyumen Gas Construction Administration--for supervising construction in the gas containing areas of the north.

4. In order to build almost all industrial structures, bases near groups of boreholes and highways, and to erect cities and settlements in Western Siberia it is necessary to cover the construction site with sandy soil. The total demand for sandy soil will

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exceed 100 million cubic meters annually and will increase. Almost all ministries are preparing the ground by a hydromechanical method. It would have been expedient to form a Special "Hydromechanization" Trust in the Ministry of Transport Construction to prepare sandy soil for all consumers. This will make it possible to better utilize the stock of earth probes, to better locate hydroalluvium stripping operations, to reduce transportation distances and at the same time significantly reduce demand for dump trucks for transporting soil.

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